(12) UK Patent Application (19) GB (11) 2 283 154 (13) A

(43) Date of A Publication 26.04.1995

(21) Application No 9421079.6

(22) Date of Filing 19.10.1994

(30) Priority Data
(31) 12668 (32) 19.10.1993 (33) FR

(51) INT CL[6]
H04Q 11/04 , H04L 12/56

(52) UK CL (Edition N)
H4K KTK

(56) Documents Cited
GB 2143404 A WO 85/05237 A1 WO 85/05236 A1

(58) Field of Search
UK CL (Edition N) H4K KTK , H4P PPA
INT CL[6] H04L 12/56 , H04Q 11/04

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(54) Device for connecting two remote local networks

(57) A device e.g. a route controller, for connecting at least two remote stations and/or local networks, via a selectable one of at least two communication networks, including a packet communication network 23 and circuit switching communication network 24, wherein the device includes means 25 of recognising the type of data flow to be transmitted, and means 22, 28 of automatic selection of one of the said communication networks to be established, as a function of said type of data flow.

In an advantageous mode the selection means 28 also takes account of already established communications 29 between the same stations and/or local networks, in such a way as to use the same communication resource if possible.

Thus, the cost of communication is greatly reduced.

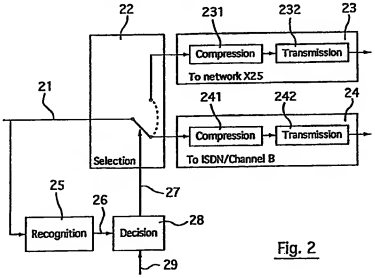

Fig. 2

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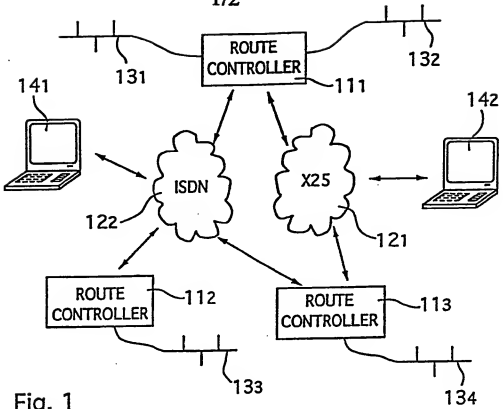
ROUTE CONTROLLER
131
132
111
141
142
ISDN
X25
122
121
ROUTE CONTROLLER
112
ROUTE CONTROLLER
113
133
134

Fig. 1

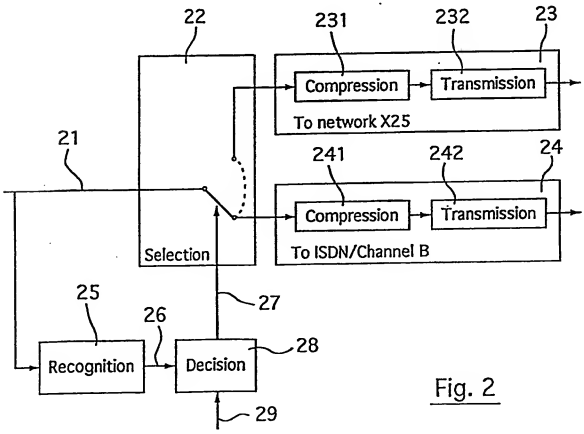
22
231
232
23
Compression
Transmission
To network X25
21
241
242
24
Compression
Transmission
Selection
To ISDN/Channel B
25
27
26
28
Recognition
Decision
29

Fig. 2

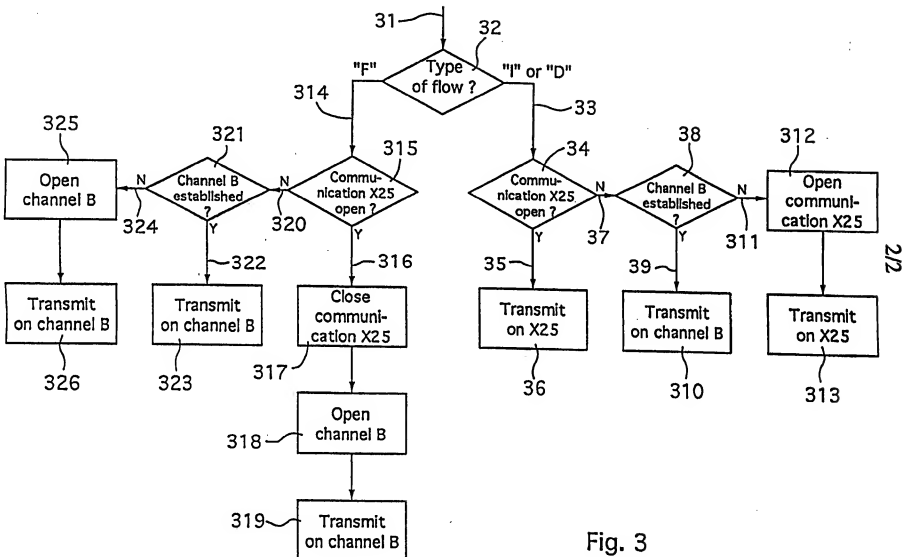
31
32
Type of flow ?
"F"
"I" or "D"
314
33
325
321
315
34
38
312
Open channel B
Channel B established ?
Commu-nication X25 open ?
Commu-nication X25 open ?
Channel B established ?
Open communi-cation X25
N
Y
324
320
37
311
322
316
35
39
Transmit on channel B
Transmit on channel B
Close communi-cation X25
Transmit on X25
Transmit on channel B
Transmit on X25
326
323
317
36
310
313
Open channel B
318
319
Transmit on channel B

Fig. 3

Device for connecting two remote local networks, and corresponding connection method.

The field of the invention is that of digital data exchange between local networks and/or remote data processing stations, by means of communication networks.

More precisely, the invention concerns a device for making a connection between two elements (networks and/or stations), and a corresponding connection method.

Data transfer operations via a communication network are often designated with the term route control. To achieve this, a connection device, or route controller is linked to a local network, capable of making the connection with an external network to exchange data with a remote element, via this external network.

Two main types of external communication networks may be defined, including packet communication networks (for example in accordance with standard X25), and more generally using protocol data units, and circuit switching communication networks, which ensure permanent connection for the duration of a communication (for example an integrated services digital network, or ISDN).

Such communication networks are managed by public or private operators which of course issue invoices for use of their network. This invoicing takes account of various criteria, depending on the type of network. In the case of a packet network, the main criteria is generally the quantity of data exchanged. In the case of an ISDN network, on the other hand, it is essentially the duration of the communication which is taken into account.

Generally, it is desirable to limit the cost of communications. However, this is not easy, as the respective costs of a communication on one or other of the types of external networks available vary greatly depending on the type of flow of the data exchanged. For example, if the applicable flow corresponds to a file to be transmitted in one single operation, a communication invoiced only on duration is preferable (on ISDN for example). On the other hand, if the flow corresponds to an interactive application (consultation of a data base for example), it is desirable that the communication is invoiced on the quantity of information exchanged, whatever the duration of the communication.

Certain route controllers allow the operator to choose the communication network which he wants to use for a particular data exchange. However, they are complex to use as each communication necessitates specific programming, depending on the network chosen and requires that the operator is capable of determining which is the least costly network, something which is not always obvious.

A particular aim of the invention is to compensate for these inconveniences in prior art.

More precisely, one aim of the invention is to supply a connection device or route controller, which is simple to use and the cost of use of which is limited, in relation to existing route controllers.

A further aim of the invention is to supply such a device enabling the transmission of several distinct flow applications, whilst limiting the cost of use of the external networks.

These aims, as well as others which will be discussed below, are achieved, according to the invention, by a connection device with at least two remote stations and/or local networks via at least two communication networks, including on one hand at least an first packet communication network, including means of recognising the type of flux application to be transmitted, and means of automatic selection of one of the said communication networks for the said communication to be set up, as a function of the said type of flow.

Therefore, the device in the invention, a route controller for example, optimises data exchanges automatically. In other words, the device provides route control which adapts itself depending on the type of flow application to be transmitted (for example a file or an interactive application).

To its advantage, this optimisation takes account of at least one of the criteria belonging to the group including:

- the mono-directional or bi-directional aspect of the communication;
- the continuous or episodical aspect of the communication;
- the response time of the said communication networks;
- the duration of the communication;

- the output of the communication;
- the communication resources available;
- the costs and conditions of invoicing associated with each of the said communication networks.

In accordance with the invention, the first packet switching network may be an X25 network, such as the TRANSPAC (Trade Mark) network for example. The second circuit switching network is, for example, an ISDN network, several channels of which are used.

In another mode of implementing the invention, a service integration digital network (ISDN) may be used including at least one digital information transfer channel (B) and at least one signalling and packet transfer channel (D). In this instance, the said means of selection selects at least one of the said channels depending on the type of flow application, the said channel D corresponding to the said first network and the said channel B corresponding to the said second network.

In this mode of implementing the invention, it should be noted that the term network in the sense of this patent application is different to that designating an ISDN network. It must be interpreted in the most general sense of being a communication support (notably designating a network (ISDN or X25), or an ISDN network channel, etc...).

According to an important characteristic of the invention, the said means of selection also take account of communications already established between the same stations and/or local networks, in such a way as to use the same communication resource if possible.

It is thus possible to greatly reduce the cost of data exchange.

Furthermore, and still with the aim of limiting costs, to its advantage, the device in the invention includes means of data compression linked to at least one of the said communication networks, and particularly to the means of data compression transmitted on the said first network.

The invention also concerns a method for connecting at least two remote stations and/or local networks by means of at least two communication networks, including on

one hand an first packet communication network and on the other hand, a second circuit switching network, involving the following steps:

- recognition of the type of application flow to be exchange;
- automatic selection of one of the said communication networks for the said application flow, as a function of the said type of flow.

Advantageously the said automatic selection stage includes, at least for certain types of flow, a hierarchised selection procedure from at least two types of communication networks, depending on the networks already used.

In this way, the selection of a communication network is adaptable and takes account of other application flows to the same destination, particularly, when possible,in order to use one single communication line.

Therefore, to its advantage, the method in the invention includes a communication optimisation stage, aiming to circulate at least two application flows of different types on the same communication line.

In a special mode of creating the invention, the said types of flow application include:

- the file flows, corresponding to file transfers;
- the interactive flows, corresponding to interactive data exchanges; and
- the default flows, corresponding to the other flows.

In this instance, the optimisation process includes the following stages:

- if the flow is a file flow and if no other way to the destination is open, opening a way on a permanent connection communication network for the duration of the communication;
- if the flow is interactive and if no way to the destination is open, opening a way on a packet communication network;
- if the flow is a file flow and if a way to the destination is open on a packet communication network, opening a way on a circuit switching communication network and closing a way on a packet communication network;
- if the flow is interactive and if a way to the destination is open on a circuit

switching network, maintenance of the said way.

To its advantage, when a way is open for the transfer of at least two distinct flow applications and when one flow is terminated, the operation of an optimum communication network is repeated.

In a preferential mode, the method includes a programming stage enabling a link to be made with at least one of the said types of application flows and/or to at least one destination to at least one preferential communication network.

Other characteristics and advantages of the invention will be revealed in the following description of a special mode of creating the invention, given by way of an example given as an illustration and not intended to be limiting, and of the diagrams in the appendix, where:

- figure 1 gives an example of a system including several local networks linked between two distinct communication networks using route controllers in accordance with the invention;
- figure 2 is a simplified functional diagram of a route controller from figure 1;
- figure 3 is a diagram of a connection method of the route controller from figure 2.

The device in the invention is intended to connect several local networks or independent processing stations. Figure 1 shows an example of a communication system which uses such devices, called route controllers.

This system includes three adaptable route controllers 11_1, 11_2 and 11_3, which may communicate via two external communication networks:

- a packet switching network 12_1, which, for example conforms to standard X25;
- a circuit switching network 12_2, of the ISDN type for example.

It enables connections to be made between local networks 13_1 to 13_4, as well as independent processing stations 14_1 or 14_2.

Route controllers made in accordance with the invention are preferably linked to two communication networks 12_1 and 12_2 (route controllers 11_1 and 11_3). However, if

necessary, they may of course be connected to a single network (route controller 11_2). A route controller 11_1) may eventually make external connections for several local networks 13_1 and 13_2.

Two situations may for example be envisaged for packet communication networks 12_1: it may be an independent X25 network for example (TRANSPAC for example) or a channel D on an ISDN system.

Figure 2 illustrates the general principle of a route controller 11_1 according to the invention. The application flow 21 to be transmitted is directed to a selector 222 which guides it either to a packet communication network 23, or to a circuit switching network 24.

Furthermore, the flow application 21 is received by a recognition module 25, which determines the type of flow application 28 of this flow application. Depending on this type 26 information, a decision module 28 guides the selector 22.

The recognition operation consists, for example, of extracting from a datagram, a piece of information describing the type of flow. There could be three types of flow application:

- the 'file' type, which in principle it is preferable to transmit on a circuit switching network;
- the 'interactive' type, which in principle it is preferable to transmit on a packet switching network;
- the 'default' type, for all applications not belonging to one of the preceding two types.

To effect route control according to the type of application, the user must first define his applications. Then he must define the route control to each possible destination. The definition of route control to a given destination (machine or network) in this case is that it is a group of ways, for which an order of selection is attributed per type of application.

Of course, it is possible to restrict the function of adaptable route control according to the invention to a destination. In this instance, the different ways will be used randomly for all applications. Furthermore, the user may prohibit an application

from being used to a given destination, in order, for example, to limit the cost of the communication (interactive to a destination outside of the limit for example).

Furthermore, the invention ensures optimisation of costs in the case of there being mixed flow applications. In effect, the decision module 28 does not only take account of the flow type information 26, but also of the other flows 29 during transfer to the same destination.

For example, we may describe the different flows in the following way:

- file flow : flow corresponding to the file transfer type applications;
- interactive flow : flow corresponding to the interactive type applications;
- default flow : flow corresponding to applications not belonging to any of the two preceding types (including therefore in fact, the applications not declared by the user).

We will consider in general that the default flow is closer to the interactive flow than the file transfer flow,as if the user does not explicitly declare an application, it is because he considers it as secondary to his need for a pass band.

When a way is open for the 'file' flow, the route controller also uses the latter to route the 'interactive' or 'default' flows, and this until the end of the file transfer. Upon completion of the latter, the route controller therefore toggles the 'interactive' or 'default' on the way best adapted to these types of flow.

On the other hand, if a way is already open for the 'interactive' or 'default' flow, the route controller does not reuse the latter to transport a 'file' flow. On the contrary, it opens a new way for the file transfer and toggles the 'interactive; or 'default' flows on the latter.

The aim of the this optimisation is to reduce invoicing considering that if a large 'pipe' is opened for the file transfer, we can take advantage of it to pass sporadic supplementary information along it.

Nevertheless, this optimisation respects the choices of the suer who is anxious to

use the widest possible pass band for his file transfers.

Figure 3 is a flow chart illustrating this technique in more detail.

The first stage 32 consists of analysing the type 31 of flow to be transmitted. If it is an 'I' (interactive) or 'D' (default) flow 33, we check (34) if a communication X25 is already open. If the response is affirmative (25), the new flow is transmitted (36) in the same communication.

If the response is negative (37), we check (38) if a channel B is open. In the case of the affirmative (39) we transmit (310) on this channel B. Therefore, when an interactive flow is in principle transmitted on a communication X25, the adaptable route controller automatically chooses the already established channel B in order to limit costs.

In the opposite case (311), an X25 communication is opened (312) on this open communication (313).

If the flow to be transmitted is of the 'F' type (file, 314, the route controller looks (315) to see whether an X25 communication is open. If this is the case (316), this communication is closed (317), a channel B is established (318) and we transmit (319) the 'file' flow on this channel B as well as the flow which was previously transmitted on line X25. Again, we note that optimisation occurs, limiting the number of communications opened simultaneously.

If no X25 communication is opened (320), we check (321) whether a channel B has been established. In this case (322) we transmit the new flow on the same channel (323).

If not (324), a channel B is opened (325), and we transmit (326) on this channel B.

Generally, the route controller therefore seeks to implement a single line of communication, and selects the one which will be the most efficient for all the flows to be transmitted.

This principle is implemented permanently and not only at the beginning of a flow. Therefore, when a flow is terminated, we check that the communication in progress is the most appropriate for any remaining flows. If the opposite is so, there is automatic toggling to another line.

Still with the aim of limiting the costs of communications, the route controller in the invention, to its advantage, includes means of compressing data, as well as the one illustrated in figure 2.

If the flow is transmitted on a circuit switching network 24, classic means of compression 241 compress the data prior to transmission (242). Eventually, several compression procedures may be implemented. The most efficient is therefore chosen, after comparison, or automatic selection is made depending on the type of flow.

If the flow is transmitted on a packet switching network 23, the means of comparison 231 are, advantageously, of the type described in French patent application FR 92 01657 of 11 February 1992 in the name of the Applicant. According to this particularly efficient technique, the data fields of the packets to be transferred are compressed, concatenated with data enabling the beginning of each first packet to be marked, then cut up to match the format of the packets intended to the communication network.

Upon receipt, the reverse operations are effected, to restore the original packets. Therefore, the number of packets actually transmitted is less than the number of source packets.

Furthermore, it should be noted that criteria other than the cost of a communication may be taken into account when selecting one network or another. In particular, the following elements may be taken into account, depending on the case in question:

- the mono-directional or bidirectional aspect of the communication;
- the continuous or sporadic aspect of the communication'
- the response time of the said communication networks;
- the duration of the communication;
- the output of the communication;
- the available communication resources.

Finally, the device in the invention is, to its advantage, completely programmable. It is the user who links up to a type of flow and/or a destination in a given network (or several, with an order of preference). Likewise, the user may force or prohibit certain

situations when necessary.

CLAIMS

1. Connection device (11_1, 11_2, 11_3) to at least two remote stations (14_1, 14_2) and/or local networks (13_1 to 13_4) via at least two communication networks (12_1, 12_2), including on one hand at least an first packet communication network (12_1) and on the other hand at least a second circuit switching communication network (12_2), characterised by the fact that it includes means (25) of recognition of the type of flow application to be transmitted and means (22, 28) of automatic selection of one of the said communication networks for the said communication to be established, as a function of the said type of flow.

2. Device according to claim 1, characterised by the fact that the said means (28) of selection take account of at least one of the criteria belonging to the group including:

- the mono-directional or bidirectional aspect of the communication;
- the continuous or sporadic aspect of the communication;
- the response time of the said communication networks;
- the duration of the communication;
- the output of the communication;
- the available communication resources;
- the cost and conditions for invoicing of each of the said communication networks.

3. Device according to either of claims 1 and 2, characterised by the fact that it uses a service integration digital network (ISDN) including at least one digital information transfer channel (B) and at least one signal and packet transfer channel (D), and by the fact that the said means (28) of selection select at least one of the said channels according to the said type of flow application, the said channel D corresponding to the said first network and the said channel B corresponding to the said second network.

4. Device according to any of claims 1 to 3, characterised by the fact that the said means (28) of selection also take account of communications (29) already established between the same stations and/or local networks, in such a way as to use the same communication resource if possible.

5. Device according to any of claims 1 to 4 characterised by the fact that it includes

means (231, 241) of data compression linked to at least one of the said communications network.

6. Device according to claim 5, characterised by the fact that it includes means (241) of compression of data transmitted on the said first network.

7. Method for connecting at least two remote stations and/or local networks via at least two communication networks, including on one hand at least an first packet communication network and on the other hand at least a second circuit switching communication network,

characterised by the fact that it includes the following steps:

- recognition (25) of the type of flow application to be exchange;
- automatic selection (28, 22) of one of the said communication networks for the said flow application, depending on the said type of flow.

8. Method according to claim 7, characterised by the fact that the said automatic selection stage includes, at least for certain types of flow, a hierarchised selection procedure selecting from at least two types of communication networks depending on the networks already used.

9. Method according to either of claims 7 and 8, characterised by the fact that it includes a communication optimisation stage, aiming to circulate at least two flow applications of different types on a same communication line.

10. Method according to any of claims 7 to 9, characterised by the fact that the said types of flow applications include:

- the file flows, corresponding to file transfers;
- the interactive flows, corresponding to interactive data exchanges; and
- the default flows, corresponding to the other flows.

11. Method according to claims 9 and 10, characterised by the fact that it includes the following steps:

- if the flow is a file flow and if no other way to the destination is open, opening (325) a way on a circuit switching communication network;
- if the flow is interactive and if no way to the destination is open, opening (312) a way on a packet communication network;

- if the flow is a file flow and if a way to the destination is open on a packet communication network, opening (318) a way on a circuit switching communication network and closing (317) the open way on a packet communication network;
- if the flow is interactive and if a way to the destination is open on a circuit switching network, maintenance (310) of the said way.

12. Method according to claim 11, characterised by the fact that when a way is open for the transfer of at least two distinct flow applications and by the fact that on termination of a flow application, the selection operation of an optimum communication network is repeated.

13. Method according to any of claims 7 to 12 characterised by the fact that it includes a programming step enabling linking at least one of the said types of flow applications and/or destnation to at least one preferential communication network.

Amendments to the claims have been filed as follows

1. Connection device for connecting at least two remote terminals via at least two communication networks, said at least two communication networks comprising at least one packet communication network and at least one circuit switching network, the device comprising means for identifying the type of flow application to be transmitted, means for identifying which, if any, communication network is already in use between said terminals, and means for automatically selecting one of said communication networks for transmitting said flow application on the basis of the type of flow and of communications already established between said terminals.

2. Device according to claim 1, in which the selecting means is arranged to take account of at least one of the following criteria:

- the mono-directional or bidirectional aspect of the communication;
- the continuous or sporadic aspect of the communication;
- the response time of the said communication networks;
- the duration of the communication;
- the output of the communication;
- the available communication resources;
- the cost and conditions for invoicing each of said communication networks.

3. Device according to either or claims 1 and 2, arranged to use a service integration digital network (ISDN) including at least one digital information transfer channel (B) and at least one signal and packet transfer channel (D), and in which the selecting means is arranged to select at least one of said channels according to the said type of flow application and any communications already established between the terminals, said channel D corresponding to said first network and said channel B corresponding to said second network.

4. Device according to any of claims 1 to 3, including

data compression means linked to at least one of said communication networks.

5. Device according to claim 4, including data compression means for data transmitted on the said first network.

6. Method for connecting at least two remote stations and/or local networks via at least two communication networks, said at least two communication networks comprising at least one packet communication network and at least one circuit switching network, the method comprising the steps of recognising the type of flow application to be transmitted, identifying which, if any, communication network is already in use between said terminals, and automatically selecting one of said communication networks for transmitting said flow application on the basis of the type of flow and of communications already established between said terminals.

7. Method according to claim 6, including a communication optimisation stage, aiming to circulate at least two flow applications of different types on a common communication line.

8. Method according to claim 6 or 7, in which said types of flow application include:

- file flows, corresponding to file transfers;
- interactive flows, corresponding to interactive data exchanges; and
- default flows, corresponding to other flows.

9. Method according to any of claims 6 to 8, including the following steps:

- if the flow is a file flow and no communication path to the destination is open, opening a path on a circuit switching communication network;
- if the flow is interactive and no communication path to the destination is open, opening a path on a packet communication network;
- if the flow is a file flow and a communication path to the destination is open on a packet communication

network, opening a path on a circuit switching communication network and closing the open path on the packet communication network; and

- if the flow is interactive and a communication path to the destination is open on a packet switching network, maintaining said path.

10. Method according to claim 9, wherein when a path is open for the transfer of at least two distinct flow applications, then on termination of a flow application, the selection operation of an optimum communication network is repeated.

11. Method according to any of claims 6 to 10, including a programming step enabling linking at least one of said types of flow application and/or destination to at least one preferential communication network.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 ("The Search report)	Application number GB 9421079.6
Relevant Technical Fields (i) UK Cl (Ed.N) H4K (KTK), H4P (PPA) (ii) Int Cl (Ed.6) H04Q 11/04, H04L 12/56	Search Examiner MR J P COULES
	Date of completion of Search 12 JANUARY 1995
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii)	Documents considered relevant following a search in respect of Claims :- 1-13

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2143404 A	(NIPPON TELEGRAPH & TELEPHONE) devices 11, 14 and 17R in Figure 1	1 and 7 at least
X	WO 85/05237 A1	(AMERICAN TELEPHONE & TELEGRAPH) Figures 1, 2 and 3	1 and 7 at least
X	WO 85/05236 A1	(AMERICAN TELEPHONE & TELEGRAPH) Figures 1, 2 and 3	1 and 7 at least

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